Stomach Contents of Flathead Catfish in the Flint River, Georgia

Stephen P. Quinn,[1] *Georgia Department of Natural Resources, Fisheries Management Section, 2024 Newton Rd., Albany, GA 31708*

---

*Abstract:*Stomach contents of flathead catfish (*Pylodictis olivaris*) from the Flint River, Georgia, were examined to gain information on basic life history of this introduced species and to assess potential impacts on traditional fisheries. Acrylic tubes and a flexible claw retriever were effective for observing and collecting stomach contents which were then analyzed by frequency of occurrence, percent composition by number, and percent composition by weight. Young-of-the-year catfish contained primarily aquatic insects and began eating crayfish, sunfish (*Lepomis* sp.) fry, and darters (*Etheostoma* sp.) toward the end of their first year. Crayfish were the dominant food item by number and weight in flathead catfish shorter than 600 mm. Flathead catfish, unidentified fish, and channel catfish were the primary teleost food items by weight in fish 301 to 600 mm in length. In flathead catfish ≥601 mm, gizzard shad (*Dorosoma cepedianum*) and sunfish were the primary teleost prey items according to frequency of occurrence; the dominant food items by weight were suckers (Catostomidae) and gizzard shad. The current flathead catfish diet suggests that adverse impacts on traditional fisheries are unlikely.

Proc. Annu. Conf. Southeast Assoc. Fish and Wildl. Agencies 41:85–92

The Flint River historically has supported popular fisheries for sunfish species (*Lepomis* spp.) as well as other game fish (Pasch 1976, Ober 1977, Scott 1981, Ellis and Clark 1986). Flathead catfish (*Pylodictis olivaris*) were introduced into the Flint River by fishermen around 1950 (C. Bryan, pers. commun.; H. Wyatt, pers. commun.). Founder stocks from the Tennessee River drainage were introduced in the vicinity of Potato Creek in Upson County, Georgia (river Km 386). Flathead catfish became established in that section of the river as indicated by dominance in rotenone samples in 1971 (McSwain 1972). Flathead catfish were already established in the Flint River below the Warwick Dam at Lake Blackshear (river Km 216) prior to the stocking of fish raised at Cordele Hatchery by the Georgia

---

[1] New address: In-Fisherman, Inc., P.O. Box 999, Brainerd, MN 56401–0999.

Game and Fish Commission in the early 1960s (M. Norton, pers. commun.; H. Wyatt, pers. commun.). Flathead catfish were first collected below the Albany Dam at Lake Worth (river Km 161) in 1974 (Pasch 1976), although anglers had reportedly begun catching them in 1972.

The piscivorous nature of flathead catfish has been well documented in small ponds (Hackney 1965, Swingle 1967), moderate-sized lakes (Bamberg 1972, Davis 1985), mainstream reservoirs (Turner and Summerfelt 1970, Edmundson 1974, Layher and Boles 1980), and rivers (Minckley and Deacon 1959, Langemeier 1965, Holz 1969, Gholson 1975, Guier et al. 1981). In some natural situations, sunfish have been an important prey species (Edmundson 1974, Guier et al. 1981), while in others they were a minor component of the flatheat catfish diet (Langemeier 1965, Turner and Summerfelt 1970, Layher and Boles 1980, Davis 1985).

The relationship between available prey abundance and the diet of flathead catfish is not well understood. Guier et al. (1981) reported increases in bluegill (*Lepomis macrochirus*) and warmouth (*L. gulosus*) abundance but declines in green sunfish (*L. cyanellus*) and redbreast sunfish (*L. auritus*) following establishment of flathead catfish in the Cape Fear River, North Carolina. However, inconsistencies in sampling gears and techniques make their conclusions speculative. Davis (1985) reported major reductions in trapnet catch rates of carp (*Cyprinus carpio*) and bullheads (*Ictalurus* spp.) following the stocking of 394 adult flathead catfish into a 45-ha Minnesota lake. In experimental ponds stocked with only flathead catfish and bluegill, all bluegill were eliminated except those too large to be swallowed, and competition for harvestable bluegill between flathead catfish and anglers in farm pond situations was suggested (Swingle 1967). Flathead catfish predation was apparently a factor in altering bluegill length distribution in another experimental pond study (Hackney 1965). Green sunfish were also preyed upon in experimental ponds, but several other fish species were preferred (Hackney 1965). Stomach contents of flathead catfish in the Flint River were analyzed to assess the potential impacts of flathead predation on the sunfish fishery and other fish populations, and to determine basic life history aspects of this introduced species.

This study was funded through Dingell-Johnson Federal Aid in Sport Fish Restoration Project F-28. I gratefully acknowledge the personnel of the Albany Region, Georgia Department of Natural Resources, Fisheries Management Section, for assistance with fish collections. C. E. Coomer, R. M. Gennings, T. B. Hess, R. D. Ober, and two anonymous reviewers provided helpful editorial suggestions.

Methods

Flathead catfish were collected between the Albany Dam and the city of Newton (river Km 111) for stomach contents analysis with a boat-mounted, pulsed DC electrofishing unit as described by Quinn (1986). Fish were collected between 0900 and 1700 from 28 May to 7 November 1985 and held in a live well for periods ranging from 5 minutes to 1 hour. Fish were collected only during warmer months because electrofishing efficiency was greatly reduced when water temperatures were below 20°C.

Acrylic tubes as described by Van Den Avyle and Roussel (1980) for use on black basses (*Micropterus* spp.) were used to remove food items from flathead catfish ⩾200 mm. Three tubes with outside diameters of 8, 25, and 38 mm were used, depending on fish size. The moistened tube was inserted into the stomach and the fish was turned so that its belly faced the sun. Sunlight permitted food items to be seen through the clear tube. Small food items would slide out of the tube and a flexible claw retriever as described by Dimond (1985) was used to extract larger items. Food items were identified to the lowest practical taxa in the field, weighed to the nearest gram, and measured if possible. A sample of catfish were eviscerated in the field to test the effectiveness of the tubes. Fish <200 mm were preserved in formalin and examined in the lab, since some items required microscopic examination for identification as well as controlled conditions for weighing.

Stomach contents were quantified by frequency of occurrence, percent composition by number, and percent composition by weight (Bowen 1983). Flathead catfish were divided into 3 size groups (⩽300 mm, 301 to 600 mm, and ⩾601 mm) for analysis of diet by predator size.

Results

The acrylic tubes were effective for observing stomach contents of flathead catfish from 200 to approximately 800 mm. The tube and flexible claw retriever were effective for collecting food items from fish in that size range, as indicated by evisceration. Flathead catfish >800 mm were difficult to examine with the tube for three reasons: 1) it was difficult to handle them properly due to their bulk and weight, 2) the thick stomach wall of large specimens would not allow sufficient light penetration for clear viewing, 3) the flexible claw retriever often did not remove large prey fish intact, especially if they were partially digested.

One hundred forty-eight of the 286 flathead catfish stomachs (51.7%) contained food items that could be identified at least to phylum. The stomach contents of the smallest size group of fish (⩽300 mm) were dominated by invertebrates. Of the stomachs in this size group which contained food items, 71.4% contained invertebrates (Table 1). Crayfish (Decapoda) were the dominant prey (30.4%). Dobsonfly larvae (Megaloptera) were found in 19.6% and unidentified insects in 17.9%. Early piscivory was indicated by the presence of darters (*Etheostoma* sp.) in stomachs of young-of-the-year flathead catfish. Centrarchids were found in only 1.8% of the stomachs. Analysis by percent composition by number indicated similar trends in diet (Table 1). Crayfish were the most important prey type by weight, followed by flathead catfish, darters, dobsonfly larvae, unidentified fish, unidentified catfish and tadpole madtom (*Noturus gyrinus*) (Table 1).

Crayfish were the most numerous food item found in flathead catfish from 301 to 600 mm in length (Table 1). Various other invertebrates were consumed, but only

Table 1. Stomach contents of three size classes of flathead catfish from the Flint River, Georgia, 1985. A = frequency of occurrence; B = % composition by number; C = % composition by weight.

Food item	All size classes (*N* = 148)			<300 mm (*N* = 56)			301–600 m (*N* = 65)			>601 mm (*N* = 27)		
	A	B	C	A	B	C	A	B	C	A	B	C
Decapoda	42.6	41.6	14.3	30.4	27.0	38.2	56.9	53.4	45.8	33.3	36.7	3.9
Ephemeroptera	1.4	1.2	0.0	1.8	1.6	0.2	1.5	1.4	0.1			
Odonata	0.7	0.6	0.0	1.8	1.6	0.2						
Unid. Insecta	7.4	6.8	0.2	17.9	15.9	2.2	1.5	1.4	0.1			
Megaloptera	9.5	8.7	0.6	19.6	17.5	6.8	4.6	4.1	0.9			
Gastropoda	0.7	0.6	0.0				1.5	1.4	0.1			
Pelecypoda	0.7	1.2	0.2				1.5	2.7	1.2			
All Invertebrata	62.8	60.9	15.4	71.4	63.5	47.6	67.7	64.4	48.2	33.3	36.7	3.9
Dorosoma cepedianum	2.7	2.5	13.6							14.8	13.3	18.3
D. petenense	1.4	1.2	0.2				1.5	1.4	0.2	3.7	3.3	0.2
Dorosoma sp.	0.7	0.6	1.1							3.7	3.3	1.5
All Clupeidae	4.7	4.3	14.8				1.5	1.4	0.2	22.2	19.9	20.0
Minytrema melanops	0.7	0.6	15.1							3.7	3.3	20.4
Unid. Catostomidae	1.4	1.2	17.4				1.5	1.4	3.5	3.7	3.3	22.7
All Catostomidae	2.0	1.9	32.5				1.5	1.4	3.5	7.4	6.7	43.0
Noturus gyrinus	0.7	0.6	0.2	1.8	1.6	2.5						
Pylodictis olivaris	5.4	5.0	11.2	8.9	7.9	20.6	3.1	2.7	19.1	3.7	3.3	8.3
Ictalurus punctatus	3.4	3.1	1.7				7.7	6.8	8.7			
I. brunneus	0.7	0.6	1.7							3.7	3.3	2.3
Unid. bullhead	1.4	1.2	4.0				1.5	1.4	0.6	3.7	3.3	5.3
Unid. Ictaluridae	0.7	0.6	0.2	1.8	1.6	3.3						
All Ictaluridae	12.2	11.2	19.0	12.5	11.1	26.3	12.3	10.9	28.4	11.1	10.0	15.9
Micropterus sp.	0.7	0.6	4.5							3.7	3.3	6.1
Lepomis macrochirus	1.4	1.2	1.6				1.5	1.4	2.3	3.7	3.3	1.6
Lepomis sp.	5.4	5.0	7.2	1.8	1.6	0.7	4.6	4.1	3.5	14.8	13.3	8.8
Pomoxis sp.	0.7	0.6	0.7				1.5	1.4	3.5			
All Centrarchidae	8.1	7.5	14.0	1.8	1.6	0.7	7.7	6.9	9.3	22.2	19.9	16.5
Etheostoma sp.	7.4	6.8	1.5	17.9	15.9	20.1	1.5	1.4	0.9			
Unid. Teleostei	11.5	7.5	2.7	8.9	7.9	5.3	15.4	13.7	9.6	7.4	6.7	0.7
All Teleostei	45.9	39.1	84.6	41.1	36.5	52.4	40.0	35.7	51.8	70.4	63.2	96.1

dobsonfly larvae occurred in more than 2% of the fish in this size group. The only other food group found in more than 10% of the stomachs was unidentified fish, 15.4%. Among the fish which could be identified, channel catfish (*Ictalurus punctatus*), sunfish, and flathead catfish were most frequently found in 7.7%, 6.7%, and 3.1% of the stomachs, respectively. Analysis by percent composition by number yielded similar results to those reported for frequency of occurrence (Table 1). Analysis by percent composition by weight shifted the balance of importance toward teleost prey (Table 1). When analyzed by weight, the importance of crayfish was reiterated, but flathead catfish were the second most important prey. Unidentified fish (9.6%) and channel catfish (8.7%) followed in importance. Unidentified suckers (Catostomidae), sunfish, and crappie (*Pomoxis* sp.) each made up 3.5% of the total weight of food items for this size group.

Crayfish occurred in 33.3% of the stomachs of catfish ≥601 mm, but no other invertebrates were found (Table 1). Gizzard shard (*Dorosoma cepedianum*) and sunfish occurred in 14.8% of stomachs. Analysis of percent composition by number illustrated the same trend in diet for the largest catfish (Table 1). Crayfish comprised only 3.9% of the prey items by weight, while teleosts made up 96.1%. Unidentified suckers and spotted suckers (*Minytrema melanops*) together comprised 43.0%, followed by gizzard shad (18.3%), sunfish (8.8%), flathead catfish (8.3%), bass (*Micropterus* sp.) 6.1%, and bullheads (5.3%).

No seasonal trends in diet were noticeable for any size group during the 5 months of collection. Most flathead catfish that contained food items appeared to have fed in the early morning, as indicated by the progressive state of digestion of items during the day. The proportion of stomachs with food was higher following increases in river level.

Discussion

Comparison of the results of diet studies is often complicated by the varied methods of quantifying stomach contents, season of collection, and the choice of different size groups for analysis of diet by predator size. Choice of food collection method has also been variable, although many methods appear to be generally satisfactory. Tubes have been used successfully on black basses (Van Den Avyle and Roussel 1980) and *Morone* species (Gilliland et al. 1981) which possess large anterior stomachs and short intestines, as does the flathead catfish. Use of stomach tubes allowed live release of flathead catfish which were tagged for use in other aspects of the project. Frequent recapture of tubed fish indicated that the procedure was relatively non-stressful for this species.

The Flint River flathead catfish population apparently relies more on crayfish than any other catfish population yet described. Crayfish entered the diet toward the end of the first year when catfish reached approximately 120 mm. Crayfish remained an important part of the diet until flathead catfish reached approximately 750 mm and 5,000 g. Crayfish comprised 30% at unchannelized sites, and 11% at channelized Missouri River sites of the total weight of prey items in flathead catfish from "yearling" size to 360 mm (Langemeier 1965). In that study, crayfish were less important for both smaller and larger specimens, although at the unchannelized site, they comprised 17% by weight in fish ≥360 mm. In the Neosho River, Kansas, crayfish were found in 13% of the stomachs of flathead catfish from 102 to 254 mm which contained food (Minckley and Deacon 1959). Frequency of occurrence of crayfish was 44% in flathead catfish >254 mm. In the Big Blue River, Kansas, crayfish were found only in fish from 102 to 254 mm where crayfish occurred in 17% of stomachs with food (Minckley and Deacon 1959). In the Cape Fear River, North Carolina, crayfish comprised only 3.75% of the total number of food items and 0.38% of the total weight (Guier et al. 1981). In the Tensaw River, Alabama, crayfish were a minor component of the flathead catfish diet, but a significant prey item for blue catfish (*Ictalurus furcatus*) in the same area (Brown and Dendy 1961). Sample size was very small in that river, however. In Bluestone Reservoir, West Virginia, Edmundson (1974) reported that crayfish frequency of occurrence was 71.4% in fish <501 mm, but only 27.1% in larger specimens. Crayfish were also an important prey of flathead catfish <500 mm in Milford Reservoir, Kansas (Layher and Boles 1980).

Young-of-the-year flathead catfish fed primarily on aquatic insects in the Flint River, Missouri River (Langemeier 1965, Holz 1969), the Big Blue and Neosho rivers (Minckley and Deacon 1959), and two Texas rivers (Gholson 1975). In the present study, darters and sunfish fry were apparently the first fish eaten by Flint River flathead catfish. In their second year, flathead catfish became cannibalistic and this species was the dominant teleost prey by weight for fish <600 mm. Cannibalism has been reported in other studies (Minckley and Deacon 1959, Langemeier 1965, Turner and Summerfelt 1970, Layher and Boles 1980), but flathead catfish were only a minor component of the diet in those waters. Other ictalurids were eaten by all sizes of flathead catfish, but none were of major importance. Gizzard shad were an important part of the diet of large flathead catfish in the Flint River as they have been in reservoirs (Turner and Summerfelt 1970, Bamberg 1972, Layher and Boles 1980) and rivers (Holz 1969, Guier et al. 1981).

Predation on centrarchid game species was common, but they were not a primary prey type. Although multiple census population estimates (Quinn, unpubl. data) indicated that flathead catfish are very abundant in the study area (124–203 fish ≥305 mm per river km), major adverse impacts on river fisheries are unlikely based on current flathead catfish diet data. Several investigators have described flathead catfish as opportunistic feeders (Minckley and Deacon 1959, Edmundson 1974, Davis 1985) and data from other studies suggests this feeding strategy. Langemeier (1965) found positive correlations between the dominant benthos and drift organisms and the diet of young-of-the-year flathead catfish at 2 Missouri River study sites. Flint River flathead catfish appear to feed opportunistically and to switch prey types at various life history stages. Further evidence for opportunistic feeding is the many instances in June and July 1985, when large flathead catfish regurgitated numerous shad fry in the live well. These food items could not be included in the stomach contents analyses due to regurgitation, but these instances do illustrate the wide size range of prey that may be ingested. The shad fry were less than 2% of the total length of the predator. At the other extreme was a 106-mm flathead catfish which had ingested and was in the process of digesting an 81-mm darter.

The electrofishing method employed was very species selective (Quinn 1986) and no data on abundance of other species were collected. Very high catch rates of small flathead catfish suggest the abundance of this prey. It is possible that flathead catfish predation following species establishment and prior to project inception could have altered the abundance and size distribution of resident fishes. Regular and extensive fish population sampling before and after species establishment would be needed to fully assess impacts, and establishment of a cause-effect relationship would still be questionable. Analysis of standing stock estimates from 12 Flint River rotenone studies from 1970 to 1976 revealed no trends between flathead catfish presence or abundance and biomass of shad, bullheads, sunfish, channel catfish, or bass.

Literature Cited

Bamberg, R. M. 1972. Flathead catfish study. Texas Parks and Wildl. Dep., Job Final Rep., Fed. Aid. Proj. F–17–R–8, Austin. 16pp.

Bowen, S. H. 1983. Quantitative description of the diet. Pages 325–336 *in* D. L. Johnson and L. A. Nielsen, eds. Fisheries techniques. Am. Fish. Soc., Bethesda, Md.

Brown, B. E. and J. S. Dendy. 1961. Observations on the food habits of the flathead and blue catfish in Alabama. Proc. Annu. Conf. Southeast. Assoc. Game and Fish Comm. 15:219–222.

Davis, R. A. 1985. Evaluation of flathead catfish as a predator in a Minnesota lake. Minn. Dep. Nat. Resour., Invest. Rep. No. 384, Fed. Aid Proj. F–26–R, St. Paul. 24pp.

Dimond, W. F. 1985. Device to increase efficiency of acrylic tubes for removing stomach contents of fish. North Am. J. Fish. Manage. 5:214.

Edmundson, J. P., Jr. 1974. Food habits, age and growth of flathead catfish, *Pylodictis olivaris* (Rafinesque), in Bluestone Reservoir, West Virginia. M. S. Thesis, W. Va. Univ., Morgantown. 78pp.

Ellis, F. S., Jr. and L. W. Clark. 1986. A survey of the fish population and sport fishery of the Upper Flint River in 1984. Ga. Dep. Nat. Resour., Final Rep., Fed. Aid Proj. F–33, Atlanta. 42pp.

Gholson, K. W. 1975. Life history of the flathead catfish (*Pylodictis olivaris*). Texas Parks and Wildl. Dep., Final Rep., Fed. Aid Proj. F–31–R–1, Austin. 15pp.

Gilliland, E. R., C. W. Kleinholz, and M. D. Clady. 1981. The efficiency of removing food items from fish with glass tubes. Annu. Proc. Texas Chap. Am. Fish. Soc. 4:95–100.

Guier, C. R., L. E. Nichols, and R. T. Rachels, 1981. Biological investigation of flathead catfish in the Cape Fear River. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies. 35:607–621.

Hackney, P. A. 1965. Predator-prey relationships of the flathead catfish in ponds under selected forage fish conditions. Proc. Annu. Conf. Southeast. Assoc. Game and Fish Comm. 19:217–222.

Holz, D. D. 1969. The ecology of the unchannelized and channelized Missouri River, Nebraska, with emphasis on the life history of the flathead catfish. M. A. Thesis, Univ. Mo., Columbia. 118pp.

Langemeier, R. N. 1965. Effects of channelization on the limnology of the Missouri River, Nebraska, with emphasis on food habits and growth of flathead catfish. M. A. Thesis, Univ. Mo., Columbia. 156pp.

Layher, W. G. and R. J. Boles. 1980. Food habits of the flathead catfish, *Pylodictis olivaris* (Rafinesque), in relation to length and season in a large Kansas reservoir. Trans. Kan. Acad. Sci. 83:200–214.

McSwain, L. E. 1972. Fish population characteristics of the fall line and Albany sections of the Flint River. Pages 151–153 *in* Flint River basin study. Ga. Water Qual. Control Board, Atlanta.

Minckley, W. L. and J. E. Deacon. 1959. Biology of flathead catfish in Kansas. Trans. Am. Fish. Soc. 88:344–355.

Ober, R. D. 1977. Upper Flint River creel and recreational use survey. Ga. Dep. Nat. Resour., Final Rep., Fed. Aid Proj. F–28, Atlanta. 52pp.

Pasch, R. W. 1976. Survey of the lower Flint River fishery and aquatic community. Ga. Dep. Nat. Resour., Final Rep., Fed. Aid Proj. F–28, Atlanta. 54pp.

Quinn, S. P. 1986. Effectiveness of an electrofishing system for collecting flathead catfish. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies. 40:85–91.

Scott, T. M., Jr. 1981. Creel survey of the Flint River between Lakes Blackshear and Worth. Ga. Dep. Nat. Resour., Final Rep., Fed. Aid Proj. F–28, Atlanta. 23pp.

Swingle, H. S. 1967. Experiments with flathead catfish (*Pylodictis olivaris*) in ponds. Proc. Annu. Conf. Southeast. Assoc. Game and Fish Comm. 21:303–308.

Turner, P. R. and R. C. Summerfelt. 1970. Food habits of adult flathead catfish, *Pylodictis olivaris* (Rafinesque), in Oklahoma reservoirs. Proc. Annu. Conf. Southeast. Assoc. Game and Fish Comm. 24:387–401.

Van Den Avyle, M. J. and J. E. Roussel. 1980. Evaluation of a simple method for removing food items from live black bass. Prog. Fish-Cult. 42:222–223.